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WORK OF THE LIFE SAVING STATIONS.

The record of the government Life Saving Service for the past year has been exceedingly gratifying. The number of disasters has been greater than in any previous year in the history of the present system. Superintendent Kimball, of the Service, states that 380 vessels in distress have received help. The total number of passengers on these vessels was 4,054, of whom 3,993 have been saved and but 61 of whom have been lost. The shipwrecked persons to receive shelter at the various stations along the coast number 658, and some 83 lives have been saved among those who have fallen from wharves or bridges. The value of the vessels and cargoes in distress is estimated at $10,000,000, and of this amount $7,688,000 have been saved. The cost of maintaining the system for the year has been $1,250,000, and the work has been considerably improved and extended.

AN INTERNATIONAL POSTAGE STAMP.

The German government is about to place a proposition before European countries relative to the issue of an international postage stamp. It is believed that such a stamp would be a boon to all who carry on any foreign correspondence. At present, if any one wishes information from a foreign country, he is unable to send a postage stamp for the reply, since no country will receive a foreign stamp as postage on an outgoing letter. One is therefore compelled to depend upon his correspondent's generosity to pay the return postage. The United States consuls in Europe, for example, are in receipt of thousands of letters of inquiry every year, not one of which contains postage for the reply. The German minister of posts has designed such an international stamp and has arranged a plan for its adoption. The stamp will contain the names of all the countries in which its value as postage is recognized, together with a table giving its value in the money of each of these countries. It is thought that only certain European countries will adopt this system, but it is to be hoped the United States will enter the agreement.

GOVERNMENT CONTROL OF RAILROADS.

The recent report of the Interstate Commerce Commission furnishes some very interesting data concerning the economic side of placing railroads under government control. According to these statistics, such management by the government has not in the majority of cases been found successful. At present there are in all 18 countries partly owning and operating the railroads of their countries. The most important of these are France, Germany, Russia, Australia, Japan, Norway and Sweden. In these countries the government fixes the tariff on all traffic, has power to revise these rates at will, and is compelled by law to reduce the rates when the earnings exceed a prescribed percentage. In the majority of cases this percentage does not exceed 15 per cent. The result of this system may be seen in part by the following significant figures. The cost of transporting freight in Great Britain is 2·8 cents per ton per mile, in France 2·2, in Germany 1·64, and in the United States 1 cent. In the case of the interest paid on the capital invested, however, England pays 4·1 per cent, France 3·8 per cent, Germany 5·1 per cent, Russia 5·3 per cent, Austria 1 per cent, Belgium 4·6 per cent and the United States 3·1 per cent. The advantage, it will be seen, is in favor of private rather than of government control. Several States, including Pennsylvania, Michigan, Indiana, Massachusetts, and others, have attempted to manage their railroads, but in every case without financial success.

CAST AND WROUGHT IRON FOR FRAME WORK OF BUILDINGS.

A trite definition of the age we live in describes it as the age of steel. Only a few years have elapsed since the production of steel was a very roundabout process, involving the long heating in a cementation furnace of wrought iron bars with nitrogenous organic matter. The wrought iron was generally produced from pig iron by the puddling process. When the steel bars were taken from the cementation furnace they had to be reforged, and if a perfectly uniform product was desired, the steel was melted in a crucible.

The inventions of Bessemer and Siemens have changed the aspect of the case. Now cast iron in quantities of five to twelve tons in the Bessemer converter is converted into steel in a few minutes. In the Siemens furnace steel is produced by melting down on the open hearth many tons of metal at once. In either process, the percentage of carbon can be regulated with great accuracy, and, notwithstanding the fact that pure iron is one of the most difficult substances to melt, either process can deliver melted steel of so low a carbon percentage as to be practically iron. The melting is so thorough that the metal flows like water.

The civil engineer and architect in times past executed their work with the most brittle of substances. If the foundation of a brick or stone building settle ever so little, one or more cracks make their appearance, unless, of course, the settling is absolutely uniform over the entire area. The best cement and toughest building stone and brick in a building are subjected to such strains that their tensile strength is but a secondary element. Briquettes of cement are tested for resistance to tensile strain, while the materials which the cement is to bind together are tested usually for compressive strength. But in the completed structure, if any irregular strain of sufficient intensity comes into existence, brick, stone and cement crack and break before a distortion of a fraction of an inch in extent is produced.

When constructors had presented for their use a material lead-like in its toughness, one which could be made to stretch and draw out of shape like iron in the blacksmith's forge, and which possessed also an enormous initial resistance to such deformation, a difficulty as old as their own art was removed. It is no wonder that within the last few years stone and brick have been given a semi-retirement, and that soft steel has been substituted for them in bridge work, and more recently in city buildings. The resistance of steel to all strains is enormously greater than is that of masonry, and if steel does yield to unforeseen strains, there is at least an impression that it will bend through a considerable arc before it will break. Engineers accordingly, perhaps over-appreciative of toughness and ductility, call for what is practically wrought iron in their specifications. The tall office buildings which have been and are being erected in the large cities of this country are made of this soft steel, as regards their frame. Their stone, brick or terra cotta fronts and walls are but sheathing; the building depends for its support upon a metallic frame.

No substance is more strikingly affected by the presence of small quantities of other elements combined with it than is iron. Without carbon it is ductile and malleable to a considerable extent, even when cold, and may be heated and suddenly or gradually cooled without any noticeable effect. But with a few tenths of a per cent of carbon combined with it, the material becomes far less ductile, and can, by heating followed by sudden cooling, be made brittle like glass. When the carbon reaches a proportion of two per cent the metal becomes cast iron, which is always brittle and rigid, and which by chilling from the fluid state becomes excessively hard and easily broken. Thus within the range of two per cent of carbon widely different products result.

The fashionable product for the use of the civil engineer of the day is virtually wrought iron, and now the impression is growing that too much faith has been placed in it. The tendency to use it is a species of reaction from the old days of brittle materials. Like many other reactions it has probably gone too far. The presence of carbon in iron does more than we have described above. It not only affects the resistance of iron to strains, but it affects its resistance to corrosion and oxidation. Soft iron acted on by the atmosphere in the presence of moisture oxidizes. The carbon dioxide of the air is probably an active element in the operation. Cast iron, on the other hand, resists oxidation almost like stone or brick. It is inferior in tensile strength to modern structural steel, and if it is subjected to a distorting strain it breaks before it bends to any extent. But it is strong enough for almost all purposes. No one supposes that the steel members of a building are to bend and twist, or even to be subjected to strains which cast iron would not perfectly resist.

This question has recently been presented to the architectural profession: Are we not going too far in using so corrodible a material as soft steel for the frame work of buildings?

A complaint or criticism which finds fault without the suggestion of a remedy is of little value. But this criticism, coming from one of the leading architects of the country, is not of this character. Our iron founders can supply cast iron which will be just as good for compression members as is steel, and which will never corrode. By bottom casting if necessary, and by rigid tests of each piece, cast iron cantilevers and columns of absolutely certain quality can be produced. The recent extensive introduction of steel castings indicates the practicability of supplying castings of comparatively low percentage of carbon, with enough carbon to make the material not corrosive, yet not so much as to make it too brittle.

It appears as if the recent rejection of cast iron as a building material has gone too far—already the signs of its new growth in favor are apparent. It would seem that in the production of special castings for tall buildings, castings of proper carbon percentage, and made by proper foundry processes, much valuable work could be done by our foundrymen and engineers. It cannot be considered an attractive practice to make the integrity of a twenty-storied building depend upon paint for protecting its frame from corrosion and ultimate destruction.

There is another point to be remembered. The integrity of a "steel cage" building frame depends on riveted joints. The rivets of these joints under strain may be expected to shear off long before the iron

beams and columns will permanently bend, so that riveted joints can be taken as introducing the breaking element into a structure made of the most ductile steel procurable. Meanwhile, if soft steel is used, it should be accessible for examination. Modern plumbing practice exposes all pipes for full access and inspection. Some similar system should be followed for the members of steel frames.

THE SNOWS OF MARS.

Among the most interesting observations of Mars during the recent opposition were those relating to the gradual disappearance of the snow cap surrounding its southern pole. The disappearance was due, of course, to the fact that it was summer in the southern hemisphere of Mars, and the polar snows melted more and more rapidly as the sun rose higher upon them. Yet, although the reason was plain, and because it was plain, one could not watch the process without experiencing a strange feeling that amounted almost to awe. It is quite easy to think dispassionately of the possibility that some things may go on in other worlds just as they do in this one as long as your eyes have not confirmed what is in your mind; but when, peering through a telescope, you actually behold such occurrences the effect is startling. It is like coming suddenly in broad daylight upon the scenery of a dream.

On the 1st of June the snow around the south pole of Mars was about 2,400 miles across. A snow cap of proportionate dimensions on the earth would, in the northern hemisphere, extend as far south as St. Petersburg, the southern point of Greenland, and Mount St. Elias, in Alaska. By the 1st of July the diameter of the snowy area had diminished to about 1,500 miles. On the 1st of August it was only 1,100 miles, and on the 31st of August, the date of the summer solstice in the southern hemisphere of Mars, the snow cap was but 500 miles across. But heat accumulates in a Martian summer after the sun has begun to decline, just as it does upon the earth, and accordingly the melting of the snows continued after the solstice was passed. At the end of September the diameter of the snow covered region was only about 350 miles, and at the opening of November it was less than 200 miles.

Now comes a curious fact. About the middle of October it was reported that the polar snow cap of Mars had vanished; some of the most powerful telescopes failed to reveal a trace of it! Yet it is not probable that it had actually entirely disappeared. The explanation of the apparent disappearance is no doubt to be found in the fact that as the snow area diminished it left the pole uncovered by receding to one side; for previous observations have shown that on Mars, as on the earth, what may be called the "pole of cold" does not correspond in location with the pole of the planet's axis. Schiaparelli's observations, in 1877 and 1879, showed that the center of the snow cap during its minimum in those years was displaced toward that side of the pole corresponding to an areographic longitude of about 40°. With the other side of the planet turned toward the earth the snow cap would have been invisible, being, so to speak, hidden behind the pole. This is apparently just what occurred in the middle of October last. The south pole was then free from ice and the center of the snowy region was displaced, as in 1877 and 1879, along the meridian of 40°. But it was the other side of the planet which was at that time presented toward the earth during the best hours for observation, and consequently no polar snow was seen; not because it had no existence, but because it was concealed.

It is probable, however, that at its minimum the snow cap was exceedingly small, perhaps less than 100 miles in diameter. No such rapid and extensive disappearance of snow and ice ever occurs upon the earth, although the advocates of an open polar sea may find encouragement in the fact that the uncovered south pole of Mars corresponds in color and general appearance with what are believed to be the water areas of that planet, while what remains of the snow cap in such circumstances rests, apparently, upon a mass of land, perhaps no more than an island, rising out of the polar ocean.

Owing to the larger eccentricity of its orbit, the extremes of temperature on Mars are greater than upon the earth, although the total amount of solar heat received by the planet is less than half as much as we get. But more important than these differences is the rarity of Mars' atmosphere, which has been so clearly demonstrated by the recent spectroscopic observations of Prof. Campbell. It may not be scientific, but it is certainly human to ask whether it is probable that beings resembling ourselves were included in the field of view of our telescopes last autumn, while we watched the southern snows of Mars sparkling to the sun and melting away at his ardent touch. If such beings are there, they must exist in an atmosphere less than one-quarter as extensive as the earth's.

GARRETT P. SERVISS.

THE harvester invented by McCormick in 1831 has been so improved that it is said it will cut and bind an acre of grain in forty-five minutes.

Motion of the Earth's Pole.

One of the most interesting questions in celestial mechanics was discussed at the recent meeting of the National Academy of Sciences at New Haven. It was the subject of a paper by Dr. S. C. Chandler, on the motion of the pole, which has been a special matter of investigation by the professor for several years. The observations thus far made, it is claimed, prove a latitude variation of 60 feet; that is, each parallel, instead of marking a fixed line on the earth's surface, indicates a line which shifts to this extent. From Lake of the Woods to Vancouver Island the forty-ninth parallel has been established as the boundary line between the United States and British America for a distance of more than 1,200 miles. Similarly the north line of New York, Vermont, and part of New Hampshire is the forty-fifth parallel for more than 250 miles. The shifting of these two boundary lines, consequently, brings alternately under the jurisdiction of the United States and Canada two strips of land 60 feet wide and 1,200 and 250 miles in length. Together they contain 11,000 acres, or enough land for one hundred good sized farms. This land was all on the Canadian side in April and May, 1890, and in May, 1891, and all on the United States side in November, 1890, and again in December, 1891.

The relative positions of the earth's pole of figure and pole of rotation, it appears, have been changing with respect to each other continually, and the course has, since 1890, been in an entwined oval spiral. This Dr. Chandler has platted, and has constructed a system of epicycles which he believes the two poles maintain with respect to each other. To put the algebraic expression in words is to say that there are two terms, one of which is an annual term, and is an elongated ellipse with a major axis of three-tenths of a second and a minor axis of eight-hundredths of a second, and the other term is a circle with a period of 428 days. These two motions superimposed give a curve, of which Dr. Chandler has made a diagram. The first three or four turns of the curve closely accord with the observations. In fact, as Dr. Chandler puts it, "theory gives latitude variations with greater accuracy than they can be determined by any individual series of observations." The curve has been continued according to the mathematic formula to the middle of 1895.

This movement of the pole is not to be confounded with the movements of precession and rotation which have long been known and carefully studied.

What is meant by the North Pole needs a little definition, for there are three north poles to the earth. One of these is the magnetic pole, where the compass needle points directly down. This was discovered and sailed over in 1831, and is situated in latitude 70, north of Hudson's Bay. Another is the geodetic pole, or pole of figure. On account of the flattening of the earth at the two frigid zones there are two points, one in each, which mark the ends of the shortest diameter of the globe, and these are the geodetic poles at the two ends of the axis of figure. The third is the astronomical pole, or pole of rotation. It has until recently been supposed to coincide with the pole of figure; but now it is known to be shifting, and the facts which Dr. Chandler has accumulated on this point afford about all the data of which we are thus far possessed.

When the variation in latitude was first suspected several years ago, two instruments were especially devised for its observation. They were made by Wanschaff, of Berlin. One of them was taken by Columbia College and the other by the Italian Royal Observatory of Capodimonte, near Naples. New York and Naples are in exactly the same latitude, and very nearly 90 degrees apart. They are, therefore, admirably situated to work together on this problem.

Through the liberality of President Low and others a special observatory was erected on the new college site at 116th Street and Amsterdam Avenue. Here observations have been conducted by Prof. John K. Rees, with the assistance of Dr. Harold Jacoby, Mr. J. T. Monell, and Mr. J. E. Davis. One or the other of these has been staying up and watching the stars every clear night since April, 1893. The plan of operation is such that very accurate results are obtained. Only stars which pass very near the zenith are observed.

The results of these observations, Prof. Rees says, will be worked out and announced in about three months. It is probable that the shape of the curve, as then determined, will, by its peculiarities, show what is causing it. At present, the causes are purely conjectural. Prof. Newcomb thinks that the shifting masses of ice and snow may be sufficient to cause it, and Prof. Scott, of Princeton, has suggested movements in the interior of the earth as the cause.

Dyed Chrysanthemums.

The practice of dyeing chrysanthemums to produce striking and unnatural color effects has become a very profitable part of the business of a fashionable florist. The pure white chrysanthemums are used for this purpose. They are colored by being submerged in different colored dyes and in many cases different colors are applied to different parts of the same flower. This work is usually done to order. If flowers are wanted to match the color of some particular dress or the drapery of a room, the customer generally brings to the florist a sample of the cloth to be matched. Chrysanthemums of any color of the rainbow can thus be prepared while you wait. Besides the plain colors, the flowers dyed half blue and half white and half orange and half black are very popular, and some curious combinations, such as the reproduction of a livid Scotch plaid, are much in demand. This singular practice is said to have grown out of the "necessity" of providing blue and white and orange and black chrysanthemums for New York's annual Thanksgiving football game.

Huge Hail Stones.

Prof. Cleveland Abbe includes the following among his notes in the Monthly Weather Review for July: On June 3 a tornado passed northeastward through the counties of Harney, Grant, and Union, in eastern Oregon. The most novel feature attending the disturbance was the hail. It is stated that the formation was more in the nature of sheets of ice than simple hailstones. The sheets of ice averaged three to four inches square, and from three-fourths of an inch to one and a half inches in thickness. They had a smooth surface, and in falling gave the impression of a vast field or sheet of ice suspended in the atmosphere, and suddenly broken into fragments about the size of the palm of the hand. During the progress of the tornado at Long Creek a piano was taken up and carried about a hundred yards.

The Fauvel Process of Treating Gold Ores.

A new method for separating gold from its ores has recently been introduced in the mining districts of Wyoming. The crushed ore is heated to a state of incandescence and quenched in a bath of cold water. As each red hot particle falls into the water, enough steam is instantly generated to shatter it, and any glaze or film is therefore ruptured. The particles of gold are thus broken down to a remarkably fine state and are rendered very brittle. The gold is clean and shining and quite free from any coating of oxide. This method makes it unnecessary to crush the ore very finely, and in addition the output of the mine is greatly increased.

Extensive Marble Belt in Georgia.

The State Geologist of Georgia reports that a belt of marble, 60 or more miles in length, has been discovered in the northern part of the State. Some of the marble, it is said, is of a flesh color tinged with green and some is a light gray banded with black. It can be obtained in large sound blocks, and is susceptible of a high polish. The report, however, suggests that on account of the mountainous character of the region in which it lies it will be costly to quarry it. If the reports be well grounded, however, there will doubtless be plenty of capital and labor forthcoming to quarry it. Many of the newspapers of Georgia are confident that it will bring great wealth to the State.

A State Park in the Catskill Mountains.

The New York State Forest Commission has recently made provision for a State park of some 30,000 acres in the heart of the Catskill Mountains. It will be situated in a very beautiful region in the vicinity of Slide Mountain, the highest peak of the entire Catskill range. This is a very populous region and may readily be reached by the local railroad. The announcement will doubtless be received with great pleasure by the many thousands who make this region their summer home.